M/035/002

BUTTERFIELD WASTE ROCK

RELOCATION

WORK PLAN

October 23, 1991

BUTTERFIELD WASTE ROCK RELOCATION

WORK PLAN

FOR

KENNECOTT WORK ACTIVITIES

SITE NO.

Submitted By:

Kennecott

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BUTTERFIELD WASTE ROCK RELOCATION
WORK PLAN

1.0 INTRODUCTION

The Butterfield Waste Rock Dumps were created during construction, in 1912, of the Butterfield Drainage Tunnel and the mine operations that followed. The Butterfield Mine operated until approximately 1952.

The Butterfield Waste Rock Site is located approximately 3 miles west of Herriman, Utah, in Butterfield Canyon (Section 12, T4S, R3W) near the portal of the Butterfield Drainage Tunnel. The area is undeveloped with less than 600 people living within a four mile radius of the site. The mine waste rock contains elevated levels of lead and arsenic and transverses the canyon, overlaying original ground on both the north and south sides of Butterfield Creek. Butterfield Creek is a perennial stream with flow ordinarily on the order of 1 to 5 cubic feet per second (cfs).

This Work Plan describes procedures for removal, transport, and containment of the waste rock from its present location to a new repository site on Kennecott property. The general design, construction, and operation of the repository site are also described. The Removal Action will be conducted during the 1991, 1992 and 1993 construction seasons.

2.0 SCOPE OF REMOVAL ACTION

The work to be completed under this Work Plan includes the removal, transport, and placement in the Repository of the Butterfield Waste Rock (in the Castro Respository). Approximately 1.4 million tons (800,000 yd^3) of waste rock covering nearly 15 acres will be relocated to Castro Gulch. Remaining native ground under the waste rock will be recontoured once removal and relocation activities are completed. Other construction activities detailed below will be implemented to facilitate removal activities in a logical sequence.

The entirety of the Castro Gulch drainage basin contains approximately 276 acres which generates a maximum flow of 2.64 cubic feet per second and a volume of 2.78 acre feet during the 10 yr. - 24 hour storm. To intercept and pass the upgradient portion of this flow through the Castro Repository, a cutoff wall will be built up gradient of the repository (Refer to Exhibit 3). After removal of the existing waste material and topsoil, a drainage pipe of adequate size will be

run from the cutoff wall through or around the repository fill and on to the existing East Side Collection Canal. A gravel drain will also be placed under, and perimeter ditches around the repository to transfer direct impacting and side gradient meteoric water to the same canal through piping within or on the surface of the waste rock. The meteoric waters infiltrating the repository materials will be gathered in a blanketed gravel low point drain down the center and will be intercepted at the toe of the repository with a second cutoff wall, and either piped or ditched into the East Side Stormwater Collection Canal.

2.1 Removal Action Objective

The objective of this Removal Action is to relocate the visible mine waste rock from the Butterfield Creek drainage, to mitigate the potential of direct public contact with the material, and to reduce the potential threat to creek water quality degradation. Removal will be based on a visually guided excavation. When native ground under the footprint of the waste rock is exposed, sampling and analysis will be conducted. This sampling and analysis will be used to determine whether further removal of soils is necessary. The Soil Sampling and Analysis Plan will guide decisions as to when sufficient waste rock and associated material has been removed. This Plan is described in Appendix C.

2.2 Removal Procedures

The waste rock will be removed using compatible excavation and transport equipment depending on creek channel features and the characteristics of waste rock deposition. Native vegetation will be left in place where practical unless it is inhibiting access or excavation.

Waste Rock is located on the north and south sides of Butterfield Creek. Butterfield Canyon Road is the only existing access road to the work area. Therefore, removal procedures will require a temporary diversion of Butterfield Creek, relocation of Butterfield Canyon Road, relocation of the existing high pressure gas pipe line along the road, and construction of the Castro Gulch repository and haul road.

2.2.1 *Temporary Diversion of Butterfield Creek*

Removal of the waste rock will require construction of temporary diversions and crossings in order to minimize increases in Total Suspended Solids (TSS) in Butterfield Creek. Diversion facilities will be implemented to protect the quality of creek water for downstream use. Water originating from Butterfield tunnel will be diverted around the work area. A sedimentation pond

will be constructed downstream of the waste rock removal activities to collect any material that inadvertently drains out of the work area. At the conclusion of the removal activities the sedimentation pond will be cleaned and sediments placed in the Castro repository. Samples of Butterfield Creek water will be taken and analyzed weekly from the creek downstream of the work area to monitor quality and possible increases in TSS during the work period. The monitoring schedule may be adjusted based on experience.

2.2.2 *Relocation of Butterfield Canyon Road*

Less than one mile of the Butterfield Canyon Road, on the north side of the Creek Channel, is now located on waste rock that is scheduled for removal. Therefore it will be necessary to relocate this portion of the road to the south side of Butterfield Creek after removal of the waste rock. The existing road will remain open to allow passage of local traffic on the north side while the south side of the channel is being excavated. When completed, the new road will be put into service prior to initiation of excavation on the north side of the channel. Flagmen or other appropriate measures will be initiated to provide safe access to or through the work area when necessary.

2.2.3 *Relocation of High Pressure Gas Line*

An existing 16 inch high pressure gas line runs parallel to the road through the north waste rock dump. Mountain Fuel crews contracted by Kennecott, will relocate the gas line to the south side of the creek, parallel to the relocated roadway.

2.2.4 *Castro Gulch Repository and Haul Road*

The Butterfield waste rock and associated materials will be removed, transported, and placed in the repository at Castro Gulch. Approximately one mile of new haul road will be constructed from the existing road to Castro Gulch on KUC property. A security gate will be constructed at the entrance to the haul road to prevent public access.

Details of transport procedures and the repository are included in sections 3.0 and 4.0, respectively.

2.3 Personal Protection

Level D personal protective equipment [(PPE)-basic OSHA construction safety equipment] will be appropriate for all

workers engaged in excavation ,transportation, and repository placement activities. Personal protection equipment will be upgraded if air monitoring results demonstrate it is necessary. Health and Safety requirements and Air Monitoring specifications are outlined in appendices A and B.

3.0 TRANSPORT PROCEDURES

Excavated waste rock will be transported to Castro Gulch over the proposed haul road on KUC property. Removal crews will control local and construction traffic to allow for safe passage of canyon vehicle traffic.

3.1 Haul Routes

A primary haul and return route has been designated for transport of waste rock from the current location to the repository. Design and construction of approximately one mile of new haul road on KUC property will be implemented to provide for haulage traffic. The haul road will be maintained, including dust suppression, by removal crews. Portions of the existing road will be crossed during hauling operations and will be maintained and/or repaired as necessary by removal crews.

3.2 Hauling Equipment

Waste rock will be hauled from its current location to the repository using off- or on-highway haul units. The size and type of haul equipment may vary due to creek channel characteristics, waste rock deposition, and space limitations throughout the work area.

Based on experience with hauling similar material and due to the short haul distance, it will not be necessary to tarp haul trucks from the loading zone to the repository. Should the release of contaminated airborne particulates be observed, increased engineering controls will be implemented, including if necessary, the tarping of vehicles.

3.3 Decontamination Procedures

Decontamination procedures will be implemented before haul equipment leaves the waste rock areas or the repository, including physically removing waste rock deposits or spillage collected on the vehicle. All material removed as a result of the decontamination activities will be collected and placed in the repository.

The new haul roads and existing roads will be decontaminated as required during the removal action. A visual inspection of

the roads will be conducted prior to completion of the project.

Decontamination will consist of removing any material that may have spilled enroute. This material will be collected and disposed in the repository.

3.4 Engineering Controls

During removal, transport, and placement operations, engineering controls such as water application will be implemented as required and where appropriate. The purpose of engineering controls is to ensure that occupational exposures for workers are maintained below acceptable levels for lead, arsenic, and total airborne dust.

3.5 Emergency Spill Contingency Plan

Any accidental spills of waste rock that may occur during transportation will be responded to by removal crews. The following measures will be implemented:

- All transport equipment will be equipped with radios to provide notification in the event of an accidental spill.
- All transport equipment carrying waste rock will be equipped with secured gates to reduce the possibility of an accidental spill.
- Appropriate equipment to be used by removal crews will be mobilized to the spill location for cleanup efforts.
- In the event of an accidental spill on the existing road, appropriate emergency response agencies will be promptly notified if traffic control or other assistance is necessary.

4.0 CASTRO GULCH REPOSITORY

The Castro Gulch repository is located approximately one mile northeast of the Butterfield waste rock in the Castro Gulch drainage. It occupies an area of approximately 15 acres, all contained within Kennecott's East Side Water Collection System.

4.1 Geology

The bedrock of the Castro Gulch area consists of limestone and sandstone of the late Paleozoic Butterfield Peaks Formation. These sedimentary rocks are intruded by middle Tertiary dikes and sills of intermediate mainly latite composition. The sedimentary section strikes approximately N50°W and dips 15-

40° NW. Both sedimentary and intrusive rocks appear to be moderately fractured locally, with syndepositional breccia zones common in the late Paleozoic sandstone. Numerous local fractured and mineralized zones are common along the contact between the Paleozoic bedrock and Tertiary intrusive bodies. Tertiary north and northwest-trending faults of unknown displacement are present in the central part of Castro Gulch; these faults in part may be related to intrusive activity.

Trenching activities in the bottom of Castro Gulch indicate general downstream thickening of slide material from the mine dumps and underlying alluvium. Depth to bedrock appears to range from approximately 8 feet near the top of the proposed repository site to 19 feet near the toe of the repository.

No tests for acid-neutralizing potential have been done for the specific rocks underlying the proposed repository, but experience elsewhere on Kennecott property suggests that it is probably weak there. Although limestones with relatively high acid-neutralizing potential are found in the bedrock of Castro Gulch, they occupy limited space beneath the repository and downgradient from it. The rocks that underlie the majority of the site and downgradient from it are Paleozoic clastic rocks and Tertiary intrusives with relatively low acid-neutralizing potential.

Permeability of the bedrock units also has not been tested at the site. Tertiary dikes elsewhere on Kennecott property have low permeability (10^{-7} cm/sec); the permeability of Pennsylvanian limestones and sandstones here is not known.

4.2 Description

The repository will be used for disposal of approximately 800,000 yd^3 of waste rock. It will consist of two cutoff walls, one up and one down gradient of the waste rock, drainage pipes from the cutoff walls to the East Side Collection System, a gravel seepage collection system ("french drain"), the waste rock, a soil cover, and perimeter ditches for run-off control.

Prior to the disposal of the waste rock at the repository, the waste material and native topsoil will be removed from the bottom of the drainage of the repository. The soil materials will be stockpiled above the repository limits for reuse. The required drains and cutoff walls will be constructed, as well as a rock drain and dike at the toe of the proposed fill.

From the upgradient cutoff wall a 14" SDR17 HDPE drainage pipe will be installed running either through or around the down gradient cutoff wall and on to the existing East Side

Collection ditch. It will be used to pass the 100 yr - 24 hr. flow of 11.5 cfs through the repository where it will be conveyed in the existing East Side Collection System to the Large Bingham Reservoir.

The seepage collection system to be installed will consist of 3/4" minus washed gravel surrounding a 6" diameter slotted HDPE collection pipe. The collection system will be underlain and overlain with a pervious geotech filter fabric. The drain system will run the center length of the repository. Water from the drain system will be collected and transmitted to the East Side Collection System by the down gradient cutoff wall (see Exhibit #4).

The waste rock will be deposited, graded, and compacted in the lower portion of the repository. Compaction to 90% of maximum dry density and a moisture content within 2% optimum are required, based on the appropriate soil curves. Waste rock deposited in the upper half of the repository will not require any compaction other than that achieved by placement equipment.

When all of the waste rock has been placed and graded, it will be covered with soil and revegetated with native grasses. A rock lined runoff ditch will be constructed around the perimeter. The surface water from this ditch will be collected at the downstream cutoff wall system and piped into the East Side Collection System.

To limit unauthorized access to the repository, a large steel gate with adjacent bollards will be installed across the repository access road. Other existing four wheel drive and off road vehicle access trails into the area will be blocked off by trenching, rock barricades, steel bollards, or fencing as the situation requires to prevent access into the repository area.

"As-built" construction details will be provided after the repository site is completed.

4.3 Air Monitoring

Air monitoring at the repository and excavation sites will be conducted to assess levels of airborne arsenic, lead, and total airborne dust. Quantitative and qualitative air monitoring will be conducted to document employee exposure levels using personal monitoring equipment.

Samples at the perimeter of work zones will be collected during work activities (initially continuous and thereafter adjusted based on experience).

Air samples will be collected and analyzed according to the Sampling and Analysis Plan for air samples included as Appendix A.

4.4 DECONTAMINATION PROCEDURES

See Section 3.3.

4.5 ENGINEERING CONTROLS

See Sections 3.4.

4.6 EMERGENCY SPILL CONTINGENCY PLAN

See Section 3.5.

5.0 OPERATIONS AND MAINTENANCE

Once all waste rock has been placed and graded, the repository area will be monitored on a quarterly basis. Monitoring shall consist of collecting air samples and inspection and cleaning of the seepage collection and surface water collection systems.

6.0 SCHEDULE OF MAJOR MILESTONES FOR WORK PLAN

1991 Initiate Repository Preparation, road construction, and water diversions.

1992 Complete road construction and water diversion Relocation of the south portion of the waste rock to the repository, and prepare repository for north side material.

Divert water into rerouted creek channel.

1993 Relocation of remaining waste rock on the north slope and reclamation of both areas. Repository completion and soil cover grading and revegetation of repository.

APPENDIX A

AIR SAMPLING AND ANALYSIS PLAN

1.0 INTRODUCTION

Air monitoring will be conducted at the work zone and Castro Gulch to monitor airborne emissions during waste rock removal and placement. Quantitative air sampling will be used to monitor employee exposures and work-zone boundaries.

The purpose of the air monitoring is threefold:

- Document employee exposure, if any;
- Evaluate the effectiveness of engineering controls; and
- Document work-zone emissions.

1.1 Personal Air Sampling Procedures

Personal monitoring will be performed with hi-flow personal sampling pumps drawing air through sampling media following the National Institute for Occupational Safety and Health (NIOSH) methodologies. Samples will be sent to a certified laboratory along with required custody documents for analysis. Sampling procedures may be altered at the discretion of field sampling personnel as site-specific conditions warrant. NIOSH sampling results are quantitative and will be used to document ambient air quality and worker exposures.

1.2 Work Zone Sampling Procedures

Prior to any activities in the work-zone and containment site, background air samples will be collected. During removal and placement activities, air samples will be collected to determine employee exposures.

2.0 AIR SAMPLING PROCEDURE

The following standard operating procedure (SOP) will be followed for all quantitative sampling conducted.

2.1 Air Sampling Sequence

The following sequence of events will be followed for all collected air samples.

1. Fill out logbook header at the beginning of the day;

2. Calibrate sampling pumps;

3. Unplug cassettes and turn on pumps;

4. Document initial information about the individual samples and conditions in a field logbook, including calibrations, start times, locations and a map or diagram; and

5. Ensure required field blank (1 per shipment) is opened and placed near a sampling pump.

At day's end:

6. Turn off pumps, record stop time in field log, and plug in cassettes;

7. Recalibrate pumps and record information in both the field logbook and the calibration documentation forms;

8. Place the pumps on charge overnight;

9. Prepare chain of custody forms for all samples; and

10. Package and ship samples, including chain of custodies.

The sequence of events is described in detail in the following sections.

2.2 Logbook Header

An up-to-date sampling field notebook will be maintained by project personnel during all sampling activities. The general information recorded for each day's sampling includes:

- Date;
- Name of overall sampling event;
- Sampling personnel;
- Climatic conditions; and
- Equipment calibrations.

2.3 Pump Calibration

Air pumps will be calibrated using a graduated burette and a soap solution or commercially available primary standard calibration device. With the first method, the pump is hooked up to an inverted buret, air is drawn through the open mouth of the buret, and a soap bubble is formed with the soap solution across the buret mouth. As the bubble moves across two pre-determined graduations on the buret, a stopwatch is used to record elapsed time. From the graduated volume and elapsed time, the volume per time, or flow, can be calculated. Enter this calibration data on a calibration form as documentation. Pumps are calibrated both before and after sampling each day.

A rotameter can also be used by establishing a calibration curve using the buret and then using the rotameter to calibrate each pump.

2.4 Logbook Sample Entries

QA/QC procedures for air sampling require completion of a Field Sampling Log. For each sample collected (including blanks), the logbook must contain:

- Sample number;
- Sampling location;
- Start and stop calibrated air flows;
- Average air flow;
- Start and stop time;
- Elapsed time;
- Sampled volume;
- Sampling method (i.e. NIOSH);
- Field observations; and
- A map or diagram.
- Date
- Signature

Significant deviations from sampling protocol shall be formally noted in the field log, along with visiting personnel and unusual circumstances which might affect the sampling.

2.5 QC Blanks

One QC blank should be submitted with each sample shipment. The blanks are opened, but unsampled cartridges are placed near an active sampler and returned to the lab with the other samples as a test for contamination during sampling and transport.

2.6 Cassette Label

To prevent misidentification of samples, each sample cassette is affixed with a label. The following information will be recorded on the sample container:

- Sample identification number; and
- Sampling personnel initials.

2.7 Chain of Custody

To establish the documentation necessary to trace sample possession from the time of collection, a chain-of custody record will be filled out and will accompany every set of samples. The record will include the following:

- List of sample numbers;
- Signature of collector;
- Date and time of collection;
- Sample types;
- Air volume sampled;
- Number of containers;
- Parameters requested for analysis for each sample;
- Signature of person(s) involved in the chain of possession; and
- Inclusive dates of possession.

2.8 Sample Packaging and Shipping

Samples will be packaged in clean areas that are remote from potential contaminant sources. Packing material will be used to stabilize the cassettes during shipment. Samples will be shipped on a weekly basis for immediate analysis.

2.9 Analytical Methods

The air samples collected using NIOSH methods will be analyzed for lead, arsenic and total airborne dust. Samples will be analyzed using NIOSH standard methods. Samples for total airborne dust will be collected separately using cassettes containing pre-weighed filters, and will be analyzed gravimetrically.

3.0 QUALITY ASSURANCE AND QUALITY CONTROL

The purpose of data quality assessment is to assure that data generated under the Quality Assurance (QA) and Quality Control (QC) program is accurate and consistent with program objectives. The quality of the data will be assessed based on accuracy and completeness. Accuracy is a determination of how close the measurement is to the true value and will be assessed by the cleanliness of field blanks. Completeness is a measure of the amount of valid data obtained, compared to the amount that was expected under normal conditions. Ninety percent (90%) completeness is the goal of this plan.

The project data objectives for accuracy and completeness are consistent with guidelines established by NIOSH and OSHA.

3.1 Sampling Calibrations

Personal sampling pumps will be calibrated following NIOSH protocol. The pumps will be calibrated at the beginning and end of sampling each day. The cassette used for pre-calibration will also be used for post-calibration. The two calibrations must not differ by more than twenty percent (20%) or the days sampling for that pump will be invalidated.

3.2 QC Samples

Internal QC checks will be conducted to evaluate the quality of data based on field conditions and constraints. The field QA/QC program will be conducted in addition to laboratory QA/QC. For each day of sampling, the following QC check will be performed:

- Field Blank - Opened but unsampled cartridge placed near an active sampler and returned to the lab with the other samples as a test for contamination during sampling and transport.

One field blank will be collected and analyzed for each sample shipment.

The above internal QC samples will be evaluated to determine if the field procedures are adequate to provide valid analytical data. The evaluation process for QC samples is outlined below.

The field blank cassette will be opened and closed by removing and immediately replacing the inlet plug to simulate contamination to sample due to handling.

3.3 Data Reduction, Validation and Reporting

All data will be reported in appropriate units. All raw data will be reviewed and validated against calibration records to ensure that data are reliable and that the data are in compliance with QA/QC objectives. Upon completion, a copy of the signed laboratory report will be maintained for future reference. Raw data from field measurements and sample collection activities that are used in project reports will be appropriately identified.

QC records, showing accumulated precision and accuracy data, will be maintained in the laboratory and reported along with analytical results. Poor quality results require that the problem be determined and corrected.

3.4 QA Reports to Management

Final field and laboratory reports will be submitted to the QA/QC Officer for review; issues requiring clarification will then be addressed. Following review by the QA/QC Officer, final field and laboratory reports will be submitted to the Project Manager.

3.5 Corrective Measures

If QC systems or performance audits result in the detection of conditions or data that do not meet QC requirements, corrective action will be initiated. The nature of the action will depend on the circumstances unique to each situation and may include:

- Evaluating and amending sampling and analytical procedures; and
- Accepting data, acknowledging level of uncertainty.

APPENDIX B

HEALTH AND SAFETY PLAN

1.0 INTRODUCTION

This Site-specific Health and Safety Plan applies to activities related to the Butterfield Waste Rock removal, transport, and placement on Kennecott property, to be conducted by employees, contractors, and subcontractors of Kennecott. This plan will be available at all times at the work area for review by employees, contractors, subcontractors, regulatory agencies, or representatives thereof. All visitors and regulatory personnel are expected to be familiar with and comply with all aspects of this plan.

The Health and Safety Plan is designed to identify, evaluate, and control health and safety hazards associated with this project. The plan is based upon existing information regarding the Site, similar work conducted in the area, and past experience at other Sites. Specific safety and health hazards and procedures necessary to protect the health and safety of employees conducting haulage, placement and construction as described.

It is expected that Site conditions may vary during the project. As actual Site conditions change, sections of the plan may be upgraded or downgraded, and will be subject to approval by the Health and Safety Officer. Such changes will be conveyed to all employees.

2.0 COMPREHENSIVE WORK PLAN

A comprehensive work plan for the operations to be conducted precedes this Health and Safety plan and describes work tasks, objectives, personnel requirements, and methods for conducting the removal, transport, and placement of the Butterfield waste rock.

3.0 JOB HAZARD ANALYSIS

The potential hazards associated with Site activities include both chemical and physical hazards. Equipment operators and laborers directly involved in project activities have the greatest potential for exposure to these physical and chemical hazards. Haulage truck operators have lower potential exposure to the hazards.

3.1 Physical Hazards

This section describes normal physical construction-Site hazards.

3.1.1 Heat Stress

Heat stress is a potential hazard associated with elevated body temperatures caused by high ambient air temperatures, heavy physical labor, or any combination thereof. With work scheduled during the spring and summer, this hazard is expected and will be evaluated on a day-to-day basis.

3.1.2 Inclement Weather

Rain, snow, extreme temperatures, or high winds may occur during schedule work activities. All employees will be trained in the hazards of exposure to cold and wet conditions. Protective clothing for cold and wet conditions will be used when needed. Severe weather conditions may result in cessation of work activities at the discretion of the Project Manager, Construction Superintendent or Health and Safety Officer.

3.1.3 Utility Lines

Appropriate precautions will be taken when working around overhead and underground utilities.

3.1.4 Noise

Exposure to elevated noise is expected for heavy-equipment operators. This hazard will be controlled by wearing hearing protection. Either ear plugs or muffs will be encouraged for heavy-equipment operators, laborers, and any other personnel working near equipment.

3.1.5 Construction

As on all construction sites, there is potential for personal injury. American National Standards Institute (ANSI) approved equipment will be required. Hard hats, steel toe boots, and safety glasses will be required to guard against head, foot, and eye injuries. Applicable MSHA and OSHA guidelines will be followed.

3.1.6 Dust Suppression

Dust may be generated during removal, transportation and placement of material. Water spray, tarping of transport vehicles, or other controls will be used, as necessary,

to reduce dust levels. Air monitoring will be conducted to ensure occupational exposures to emissions from the work zone of dust and particulates are below accepted safe levels.

The OSHA Permissible Exposure Limit (PEL) for Total Suspended Particulates (TSP) is 15,000 micrograms per cubic meter in air for any 8-hour time-weighted average (29 CFR 1910.1000).

3.1.7 Other Physical Hazards

Other physical hazards such as insect bites, stings, etc. may occur during construction and placement operations. Precautions will be taken to prevent these hazards.

3.2 CHEMICAL HAZARDS

Based on available information regarding the Site, contaminants identified in the waste rock are arsenic and lead. If additional chemical hazards become evident, appropriate measures will be taken to protect the health and safety of personnel on the Site and prevent off-site migration. All employees will be notified of any new hazards as they become known.

3.2.1 Arsenic

Arsenic is a solid material with no odor. Potential exposure routes are through inhalation or ingestion. Skin contact can also result in adverse effects. Some arsenic compounds may cause irritation of the eyes, mucous membranes, respiratory system and skin. Dermatitis can also result from poor personal hygiene when working around these materials. Excessive inhalation of arsenic may result in respiratory problems such as coughing, chest paid, giddiness, headache, and extreme weakness preceding gastrointestinal symptoms. Prolonged exposure can result in weight loss, nausea, diarrhea, pigmentation of skin, and loss of hair. Arsenic is considered a carcinogen: a cancer-causing substance.

The OSHA PEL for arsenic is 10 micrograms per cubic meter in air for an 8-hour time-weighted average. The OSHA Action Level (AL) for arsenic is 5.0 micrograms per cubic meter in air for an 8-hour time-weighted average (29 CFR 1910.1018).

3.2.2 Lead

Lead is a solid material with no odor. Potential exposure routes are through inhalation or ingestion. The early effects of overexposure to lead are nonspecific and, except by laboratory testing, are difficult to distinguish from the symptoms of minor seasonal illnesses. The symptoms are decreased physical fitness, fatigue, sleep disturbance, headache, aching bones and muscles, abdominal pains, and decreased appetite. More advanced effects include anemia, pallor, a "lead Line" on the gums, and decreased hand grip strength. Lead colic produces intense abdominal pain with nausea and vomiting. Headache, convulsions, coma, delirium, and kidney damage can occur. Lead is not considered a carcinogen but it is classified as a reproductive toxin and a teratogen (fetal malformation).

The OSHA PEL for inorganic lead is 50 micrograms per cubic meter in air for an 8-hour time-weighted average. The OSHA AL for lead is 30 micrograms per cubic meter in air for an 8-hour time-weighted average (29 CFR 1910.1025).

3.3 HAZARD MITIGATION

The hazards identified in the above sections, and any additional hazards which arise or are identified during the work, will be mitigated by personal protective equipment (PPE), engineering controls, and other safety procedures. Physical hazards will be mitigated by the implementation and enforcement of standard operating procedures described in Section 9.0. Chemical hazards will be identified through the air monitoring program described in Section 7.0 and mitigated by the use of engineering controls.

4.0 TRAINING REQUIREMENTS

All project employees will receive as a minimum 8 hours of Hazardous Substance Awareness Training. All employees and supervisors involved with daily activities will be required to have 40-hours of hazardous substance training (OSHA 1910.20). Employees will be trained to a level required by their job function and responsibility before being permitted to engage in field activities. Pre-employment safety information will include:

- Names of personnel and alternates responsible for Site safety and health;
- Chemical and physical hazards present on the Site;
- Work practices by which risks from hazards can be minimized;

- Detailed review of this Site-specific health and safety plan;
- Safe use of engineering controls and equipment on the Site;
- Use of Personal Protective Equipment; and
- Medical surveillance requirements, including recognition of symptoms and signs which might indicate overexposure to hazards.

Site safety meetings will be held at least weekly to notify personnel of specific hazards, air monitoring results, changes in Health and Safety Plan, or other topics determined by the Site Health and Safety Officer. Specific meetings will be held at the initiation of new or different field activities and at the time of any crew or subcontractor crew changes.

5.0 PERSONAL PROTECTIVE EQUIPMENT

Occupational exposures to arsenic, lead, and TSP are expected to be well below action levels specified in CFR 1910.1018, 1025, and 1000, respectively. Therefore, the level of personal protection to be utilized for all initial Site activities is Level D. Level D shall consist of a hard hat (ANSI Z89), safety glasses, (ANSI Z87), steel-toed boots (ANSI Z41 with substantial leather 6-inch uppers), cotton gloves, coveralls, and hearing protection as necessary. The level of protection will be adjusted according to results of employee exposure monitoring, specific job functions, or as Site conditions change.

6.0 MEDICAL SURVEILLANCE PROGRAM

A medical surveillance program provides a means of selection of employees who are physically able to safely perform the work assigned and monitor their health on a regular basis. The medical surveillance program to be implemented for this project will comply with 29 CFR 1910.120(f).

The program consists of a pre-employment medical evaluation to determine fitness for the job assignment, an annual evaluation based on length of assignment, and an end-of-employment evaluation. In addition, a special evaluation is warranted when an employee indicates that they may have developed symptoms resulting from a possible exposure to hazardous substances.

Medical surveillance will be conducted for all Site personnel who may be exposed to arsenic and lead in excess of PELs, without regard to the use of respirators, for 30 days or more per year. All personnel participating in the medical surveillance program will have an annual examination which equals or exceeds the following:

- Medical and Occupational History;
- Physical Examination;
- Pulmonary Function Test;
- Six Frequency Audiogram;
- Urinalysis, with microscopic morphology and dipstick;
- Complete Blood Count;
- CHEM 20 Chemistry Screen;
- SAM 10 Drug Screen;
- Chest X-Ray; and
- Blood lead and 24-hour urine arsenic levels

All contractor personnel with the potential for chemical exposure are required to have medical monitoring which equals or exceeds this program. Visitors and regulatory personnel who will enter the work area may be required to demonstrate participation in a medical program which is equivalent to or exceeds this program. The Health and Safety Officer will determine which personnel must meet training and medical-monitoring requirements.

Prior to the start of the project activities, all employees with potential for exposure will have a baseline evaluation conducted for lead levels in blood and urine arsenic levels. These evaluations are to be repeated at the completion of work activities or end of employment, as deemed necessary by the Health and Safety Officer.

Copies of the physician's written opinion for the capability of the individual to work in areas with a potential for arsenic and lead exposure and the ability to wear a respirator will be maintained by the Health and Safety Officer for all workers on Site.

7.0 AIR MONITORING

Air monitoring will be conducted to evaluate the potential for employee exposure and to determine the overall contribution of work activities to ambient air quality. Prior to any activities on Site, background air samples will be collected. During excavation placement activities, qualitative and quantitative air sampling will be conducted to determine employee exposures. All air samples will be collected and analyzed according to the appropriate National Institute of Occupational Safety and Health (NIOSH) method for determining concentrations of arsenic, lead, and total suspended particulates (TSP). (See Appendix A to the Work Plan).

7.1 Occupational Air Monitoring

Quantitative personal samples will be collected using Gilian constant-flow pumps calibrated using a rotameter or "bubble tube" to draw between 1.0 and 2.0 liters of air per minute.

The collection medium is a filter made of a mixed-cellulose ester. The minimum collection time is 7 hours. The samples will be handled under chain-of-custody procedures and delivered to a qualified laboratory for analysis. (See Appendix A to the Work Plan)

Employees with the highest potential for exposure will be selected for personal monitoring. At the start of field activities and periodically thereafter, occupational air samples will again be collected and analyzed for arsenic, lead and TSP. Additional air monitoring will be conducted whenever there is a change in work conditions which can be expected to result in new or additional exposure levels or whenever an employee complains of symptoms which may be attributable to exposure to lead or arsenic.

Qualitative work zone air monitoring for TSP will be conducted using real-time instruments which measure the light-scattering effect of particulates.

8.0 DECONTAMINATION PROCEDURES

Equipment decontamination will be conducted on Site as appropriate. Equipment decontamination will consist of physically removing visible contamination from contact points of the equipment at completion of work tasks and before leaving the work area.

Personal decontamination will consist of good personal hygiene. Employees will be required to wash with soap and water at each break and lunch period and at the end of the work shift.

Decontamination procedures will be monitored by the Health and Safety Officer to determine their effectiveness. If such procedures are found to be ineffective, they will be altered to correct any deficiencies.

9.0 STANDARD OPERATING PROCEDURES/SAFE WORK PRACTICES

Standard operating procedures and safe work practices for this project consist of Kennecott General Safety for Contractors in addition to the following:

- No alcohol, firearms, or illegal drugs will be allowed on Site. Anyone reporting to work under the influence of alcohol and/or illegal drugs will be discharged immediately.

- Any employee under a physician's care and/or taking prescribed medication must notify the Site Health and Safety Officer.

- Eating and drinking are allowed only in designated areas and never in the repository.

- All personnel shall listen for warning signals on construction equipment and shall yield to construction equipment.

- All equipment operators shall pay careful attention to workers on the ground who may be in their path and provide warning to these people before moving. All employees working regularly on the ground will wear orange vests with reflective tape. Operators shall also pay deliberate attention to all types of utility lines and sources.

- All personnel are required to be familiar with and abide by the security rules, and emergency procedures.

- All personnel must report any injuries, vehicle accidents, and/or illnesses to their supervisor. This includes minor slight injuries.

- All prospective employees must pass a pre-employment physical and subsequent exams as required by this plan. Failure to submit to, or pass, any exam will be grounds for dismissal.

- All personnel must participate in the air-quality exposure monitoring program by wearing personal monitors or sampling devices designated by the Site Health and Safety Officer. Any personnel refusing to participate in the program, or who tamper with the sampling devices, will be subject to disciplinary action or expulsion from the Site.

- All personnel must abide by all safety rules and procedures as described in the work rules and/or throughout the project.

APPENDIX C
SOIL SAMPLING AND ANALYSIS PLAN

C.1.0 INTRODUCTION

During the removal action soil will be sampled and analyzed to document soil conditions following removal. Composite soil samples will be collected and quantitatively analyzed. The sampling program for quantitative analysis is designed to fulfill the data requirements of the removal action which includes:

- The samples collected are representative of the materials sampled;
- Sample integrity is maintained and documented;
- Proper measurements and information are recorded;
- Sample volumes are sufficient for the required analytical procedures;
- Analytical results adequately characterize soil; and
- The sampling protocol is efficient and relatively uncomplicated.

C.2.0 POST-REMOVAL SAMPLING PROCEDURE

The following sections outline the standard operating procedure (SOP) to be followed in conducting sampling for quantitative analysis specified in the Work Plan. The Site Health and Safety Plan will be followed at all times during sampling.

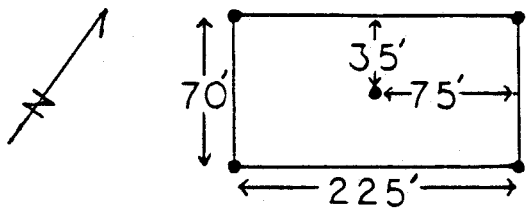
Composite samples will be collected from the post-removal area. Each composite sample will consist of five subsamples from proposed locations which are pre-selected to provide adequate coverage for all areas excavated. (see Exhibit 5).

C.2.1.0 SUB-SAMPLE LOCATIONS

All proposed subsample locations will be predetermined as shown on Exhibit 5. Actual ground locations may be modified to accomodate adequate coverage for all removal areas. Each sample will consist of 5 subsamples composited into one sample. Compositing methods are described in Section C.2.2.1. Subsample locations north and south of Butterfield Creek and, along the banks and creek bottom are described as follows:

Areas North and South of Butterfield Creek

These areas include removal locations north and south of Butterfield Creek. Post removal sampling will include approximately 10 composite samples. Each composite sample will be 225′ apart from center point of composite to center point of adjacent composite with 2 subsample sites common with the adjacent composite sample. The composite will be spatially arranged as follows:



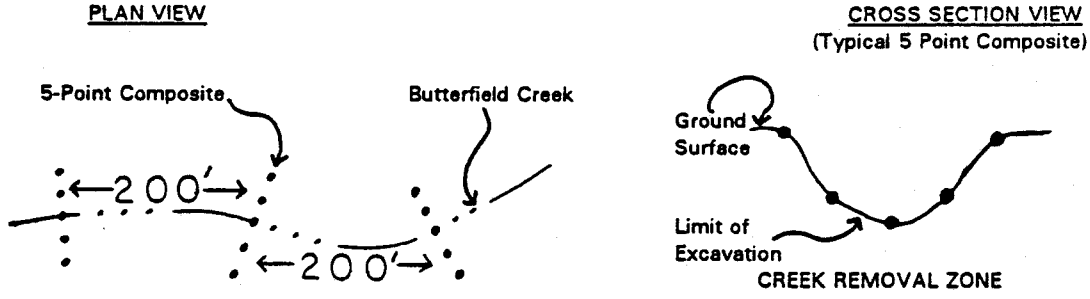
Where • is a subsample location

Actual subsample locations may be placed in the field at a slightly different configuration than diagramed to facilitate adequate coverage for removal areas.

Area Located Along the Banks and Butterfield Bottom

This area includes removal areas in and along the banks of Butterfield Creek. Post removal sampling will include approximately 7 composite samples.

Each composite sample will be located perpendicular to the creek. Each composite will be approximately 200′ apart and will be designed as follows:



Where • is a subsample location

The sample locations will be located in the field by tape and compass methods and will incorporate control points previously established. Control points will include cultural features and/or surveyed control points. All locations will be recorded in the field log book.

C.2.2.0 Sample Collection

The soil samples will be collected using disposable plastic or other hand tools. The quantity of material sampled at each subsite will be approximately 1/4 to 1/2 lbs. Soil samples will be collected from the top 4 inches at the sampling location.

C.2.2.1 Generation of Composite

Sample containers will be 12" x 17" polyethylene bags. Each bag will be taped closed after sample collection and homogenized. Composite homogenization will occur by thoroughly shaking the sample in a vertical and horizontal motion.

C.2.2.2 Sampling Sequence

The following sequence of events will be followed for all collected soil samples.

1. Fill out logbook header at the beginning of the day;

2. Document initial information about the individual samples and conditions in a field logbook, including a map or diagram;

3. Label container with sample number, date, time, any comments, and samplers' initials;

4. Collect the sample. As a precautionary measure always collect twice the required sample volume;

5. Place soil samples in separate sample containers.

6. Record sample description in the field logbook; and

7. Ensure required duplicates (10%, i.e.~every tenth sample), are included.

At days end:

8. Completed chain-of-custody forms for all samples;

9. Package and ship samples, including chain of custodies.

Each sequence event is described in detail in the following sections.

C.2.2.3 Logbook Header

An up-to-date sampling field notebook will be maintained by on-site personnel during all sampling activities. The general information recorded for each days' sampling event includes:

- Date;
- Name of overall sampling event
- Sampling personnel; and
- Climatic conditions;

C.2.2.4 Logbook Sample Entries

QA/QC procedures for soil sampling require completion of a Field Sampling Log. For each sample collected, the logbook must contain:

- sample number;
- location;
- time;
- sampling method;
- field observations; and
- a map or diagram.

Significant deviations from sampling protocol should be formally noted in the field log, along with visiting personnel and unusual circumstances which might affect the sampling.

C.2.2.5 Container Label

To prevent misidentification of samples, each sample container will be affixed with a label. Labels will be written with indelable ink and will be sufficiently durable to remain on the container. The following information will be recorded on the sample container:

- Sample identification number;
- Name of sampling personnel;
- Date and time of collection; and
- Location.

C.2.2.6 Decontamination

All non-disposable sampling equipment will be cleaned when moving to a different sampling point to prevent cross-contamination. All samples will be collected with disposable plastic spoons. In the event if other hand tools are needed, the equipment Decontamination Procedures are as follows:

1. Remove gross contaminants

2. Wash with Alconox or other lab soap

3. Rinse with tap water

4. Triple-rinse with deionized water

5. Repeat all or part of the procedure, if necessary.

Field personnel conducting the equipment decontamination and sampling will be required to wear protective gloves and the personnel protective wear required under the Site Health and Safety Plan. The decontamination procedures used will be recorded in the field logbook.

C.2.3.0 Chain of Custody

Chain-of-custody forms should be available in the field. If for any reason, the sampling foreman must leave, he should sign off of the chain of custody form and his assistant or replacement should sign on and assume responsibility for sample custody.

To establish the documentation necessary to trace sample possession from the time of collection, a chain-of-custody record will be filled out and accompany every set of samples. The record will include the following:

- List of sample numbers;
- Signature of collector;
- Date and time of collection;
- Sample types;
- Number of containers;
- Parameters requested for analysis for each sample;
- Signature of person(s) involved in the chain of possession; and
- Inclusive dates of possession.

C.2.4.0 Sample Packaging and Shipping

Sample preparation and packaging will be conducted in clean areas that are remote from potential contaminant sources. The soil samples will be secured in shipping containers. Packing material will be provided to stabilize the shipping containers if necessary.

Samples will be delivered to the laboratory within 12 hours of sample collection. In cases where samples will leave the immediate control of project personnel, a seal will be affixed to the sample container to ensure that

the samples have not been disturbed during storage or transportation. The integrity of the seal will be observed and documented upon arrival at the laboratory.

C.2.5.0 QA Objectives

The purpose of data quality assessment is to assure that data generated under the QA program is accurate and consistent with program objectives. The quality of the data will be assessed based on precision, accuracy, and completeness. Precision is the degree to which a measurement is reproducible and will be assessed by a review of duplicate analyses. Accuracy is a determination of how close the measurement is to the true value and will be assessed via spike recovery in sample matrices. Completeness is a measure of the amount of valid data obtained, compared to the amount that was expected under normal conditions. Ninety-five (95%) percent completeness is the goal of this removal action. The project data objectives for precision, accuracy, and completeness are consistent with guidelines established by the EPA Contract Lab Program.

C.2.6.0 QA/QC Samples

Ten percent of all samples will be split and analyzed at a second lab. The analysis comparisons will be made to insure accurate and reproducible results are ascertained from each laboratory.

C.2.7.0 Analytical Method

The soil samples will be analyzed for lead and arsenic according to appropriate EPA Methods. The soil samples will be analyzed in Salt Lake City, Utah.

All analytical methods will be consistent with established state and federal guidelines.

C.2.8.0 Data Reduction, Validation, and Reporting

All data will be reported in appropriate units. All raw data will be reviewed and validated against calibration records to ensure that data are reliable, and that the data are in compliance with QA/QC objectives. Upon completion, a copy of the signed laboratory report will be submitted for Agency review.

Raw data from field measurements and sample collection activities that are used in project reports will be appropriately identified.

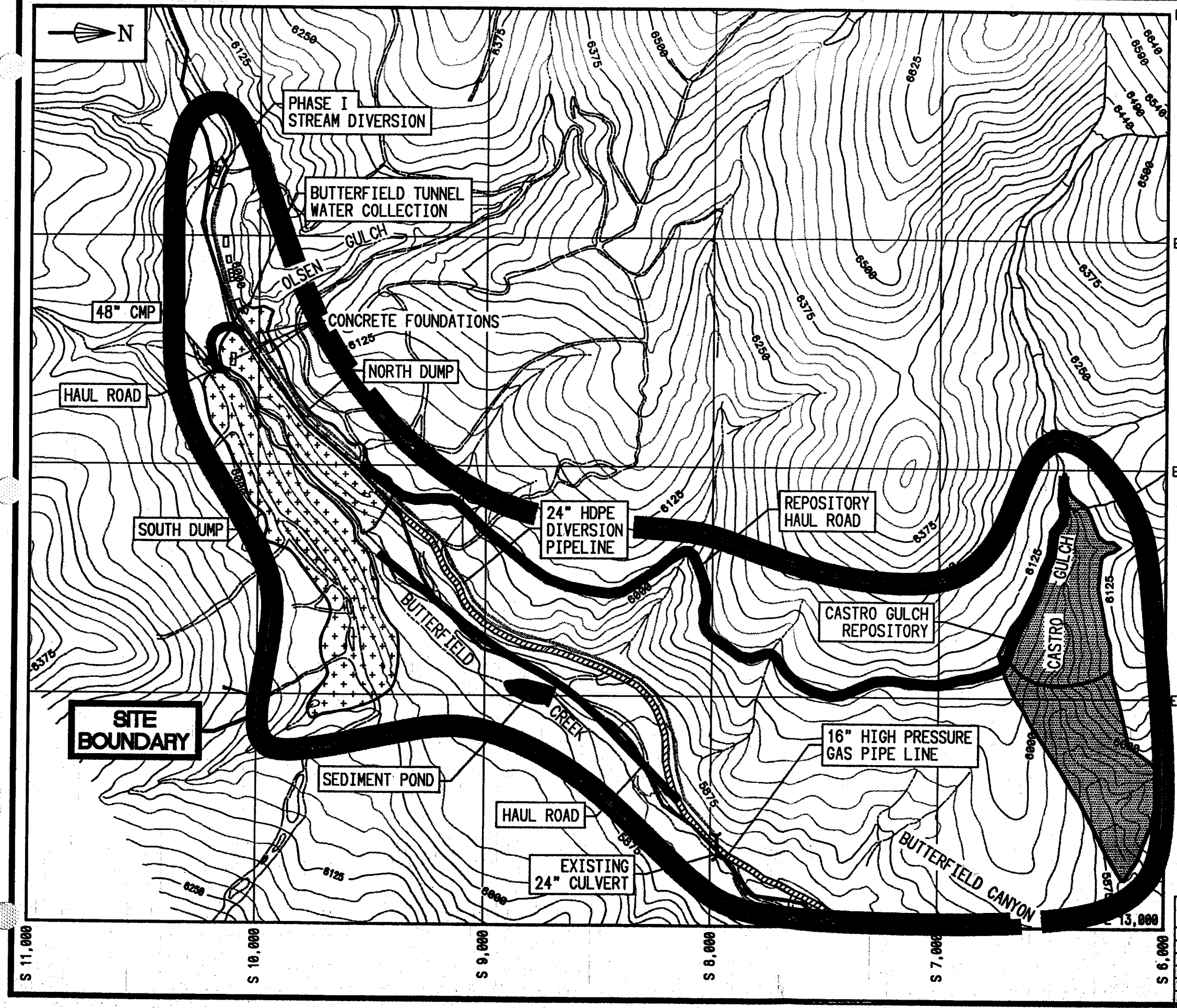
QC records, showing accumulated precision and accuracy data, will be maintained in the laboratory and reported along with analytical results. Poor quality results require that the problem be determined and corrected.

C.2.9.0 Corrective Action

If QC results detect a condition or data that do not meet QC requirements, corrective action will be initiated. The nature of the action will depend on the circumstances unique to each situation and may include:

- Reanalyzing the samples, if holding time criteria permit;
- Resampling and analyzing;
- Evaluating and amending sampling and analytical procedures; and
- Accepting data, acknowledging level of uncertainty.

EXHIBIT #1



NOTE:

THE SITE, FOR PURPOSES OF THIS ORDER, INCLUDES THE AREAL EXTENT OF WASTE ROCK DEPOSITION AND AREAS AFFECTED BY WASTE ROCK IN BUTTERFIELD CANYON, STAGING AREAS FOR THE REMOVAL ACTION, THE CASTRO REPOSITORY, AND TRANSPORTATION ROUTES TO THE REPOSITORY. THE SITE IS DEPICTED ON THIS EXHIBIT #1 AS THAT AREA OUTLINED BY THE BLACK BORDERED RED LINE.

LEGEND

- CORRUGATED METAL PIPE (CMP)
- 16" HIGH PRESSURE GAS PIPELINE
- 24" HDPE DIVERSION PIPELINE
- HAUL ROAD
- ASPHALT ROAD
- DIRT ROAD
- BINGHAM MINE WASTE DUMP
- BUTTERFIELD MINE WASTE DUMP
- CASTRO GULCH REPOSITORY

NOTES:
1 - TOPOGRAPHY DERIVED FROM "1988" AERIAL MAP.

0 200 400
SCALE IN FEET

PLANT PROJECTS GROUP	KENNECOTT UTAH COPPER
SCALE: GDL RKC / DATE: 6/28/89 6/28/89	BUTTERFIELD MINE WASTE DUMPS REMOVAL ACTION SITE BOUNDARY
Job No. ----	Dwg. No. 451-T-452 3

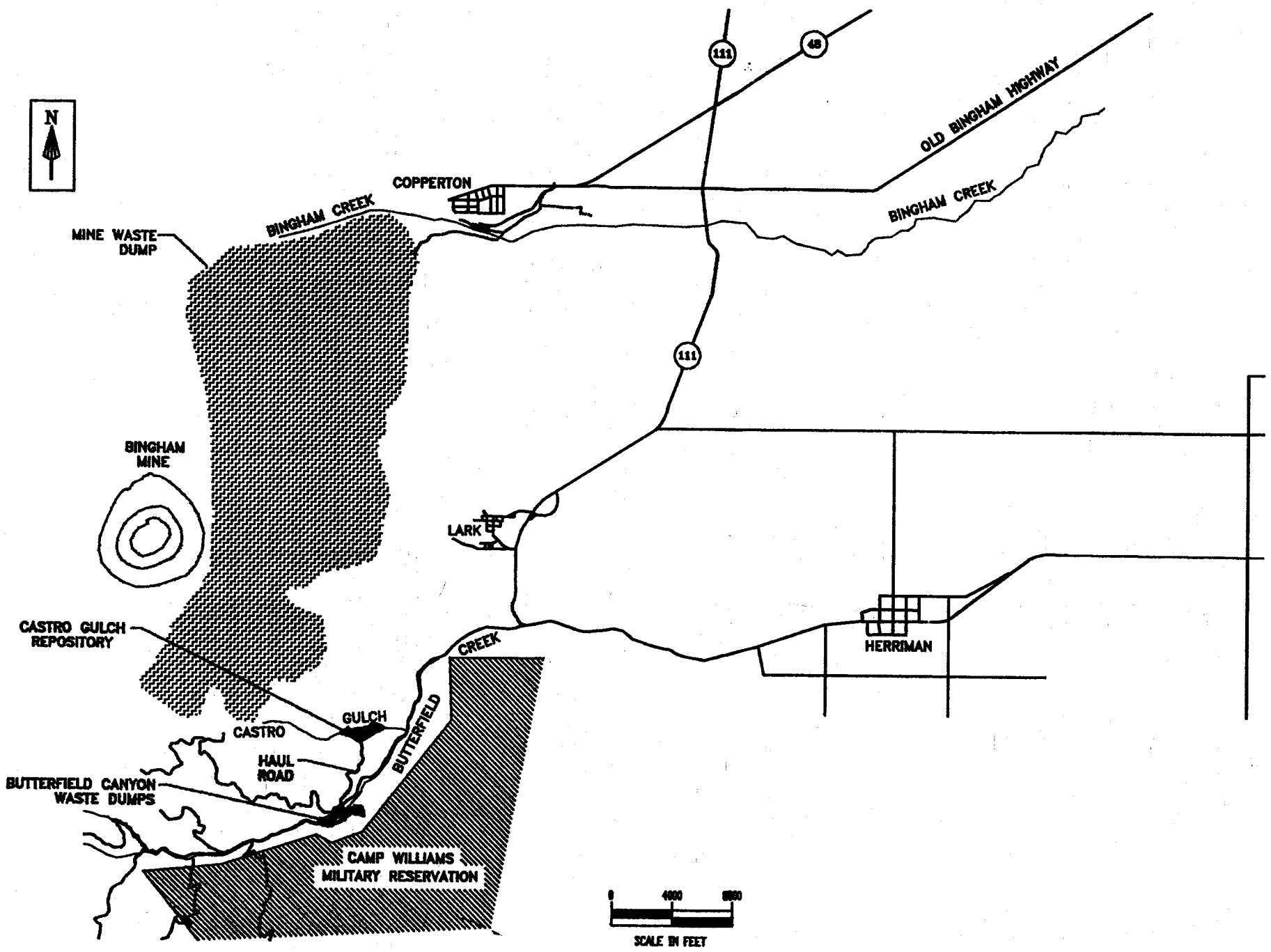


EXHIBIT #2

PLANT PROJECTS GROUP		KENNECOTT UTAH COPPER
SCALE	DATE	KEY PLAN FOR RELOCATION OF BUTTERFIELD MINE WASTE DUMPS
GDL	6/21/95	
RKC	6/21/95	
Job No. ----	Dwg. No. 451-T-450	REVISION 3

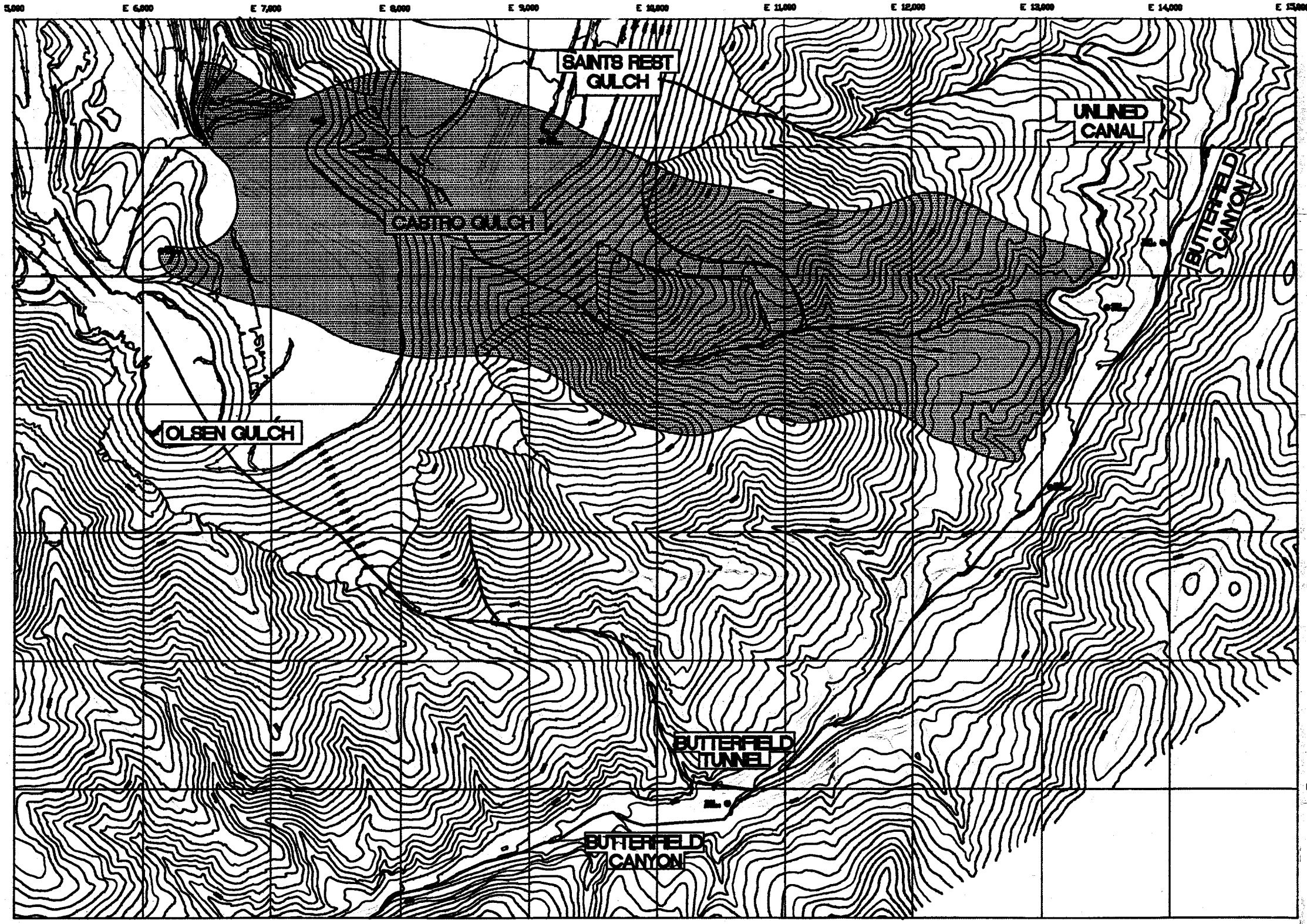


EXHIBIT #3

LEGEND

- LOWER EASTSIDE - NATURAL DRAINAGE AREA
- EASTSIDE DUMPS DRAINAGE AREA

NOTE:

TOPOGRAPHY DERIVED FROM "1990" AERIAL MAP.

N

400 0 800 400

SCALE IN FEET

CASTRO DRAINAGE BASIN - SURFACE RUNOFF HYDROLOGY

ACREAGE: DUMPS 193.2 ACRES
LOWER EASTSIDE 193.0 ACRES

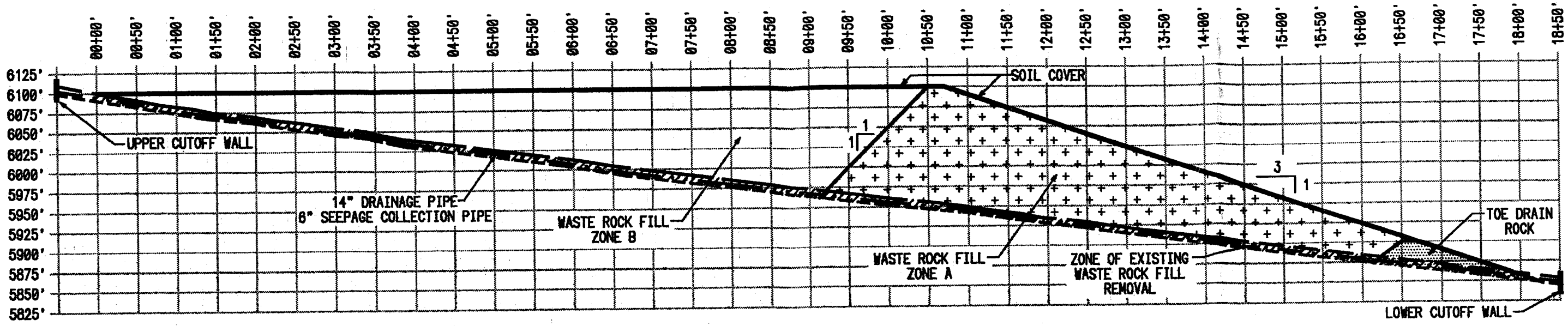
10 YR - 24 HR.	FLOW (CFS)	VOLUME (AC-FT)
	2.64	2.78

PLANT PROJECTS GROUP				
APPROVAL	DATE	WORLD		
			JAF	1/27/93

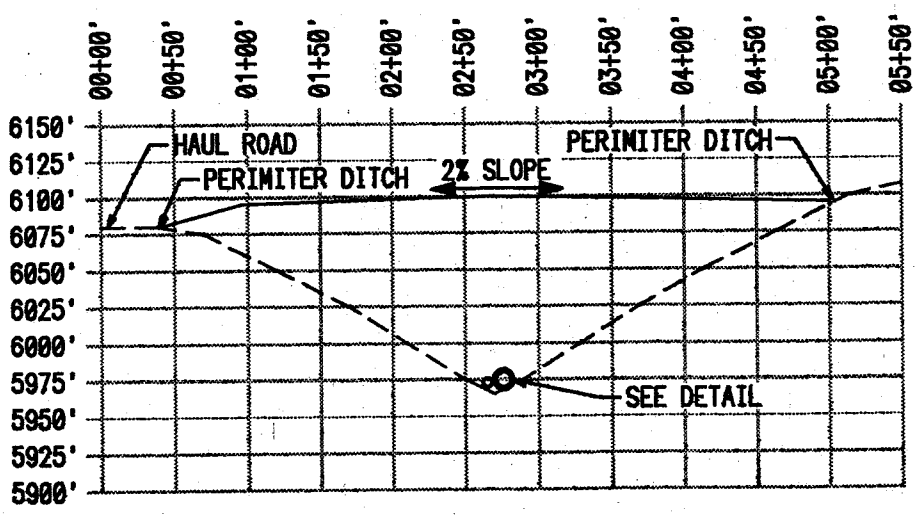
KENNECOTT
UTAH COPPER

CASTRO GULCH
SURFACE RUNOFF HYDROLOGY

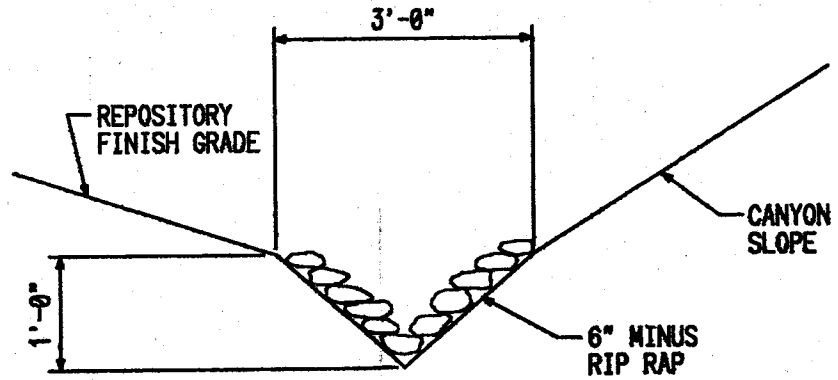
Job No. | Dwg. No. 451-T-389 | Rev. 0



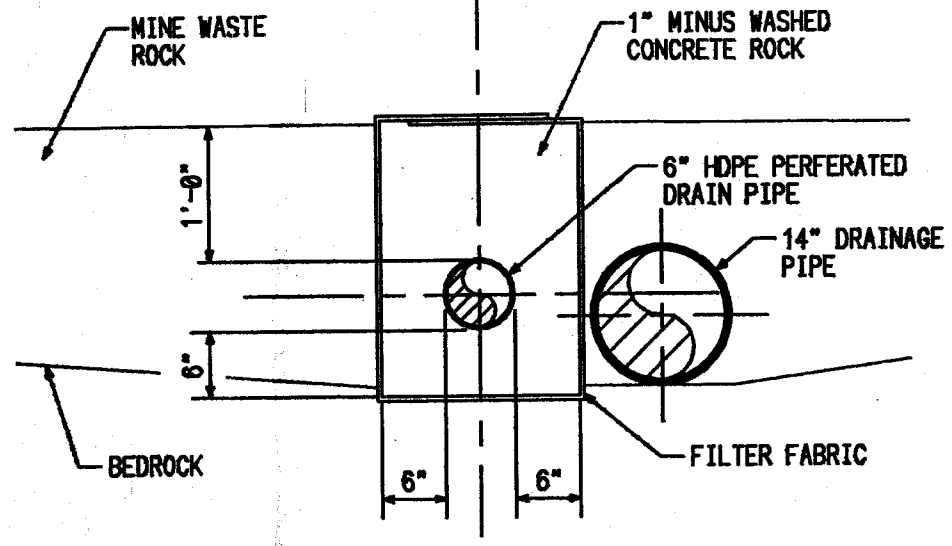
SECTION "C-C"
CASTRO GULCH



TYPICAL CROSS-SECTION
AT STATION 9+00



REPOSITORY PERIMETER DITCH
TYPICAL BOTH SIDES
NO SCALE



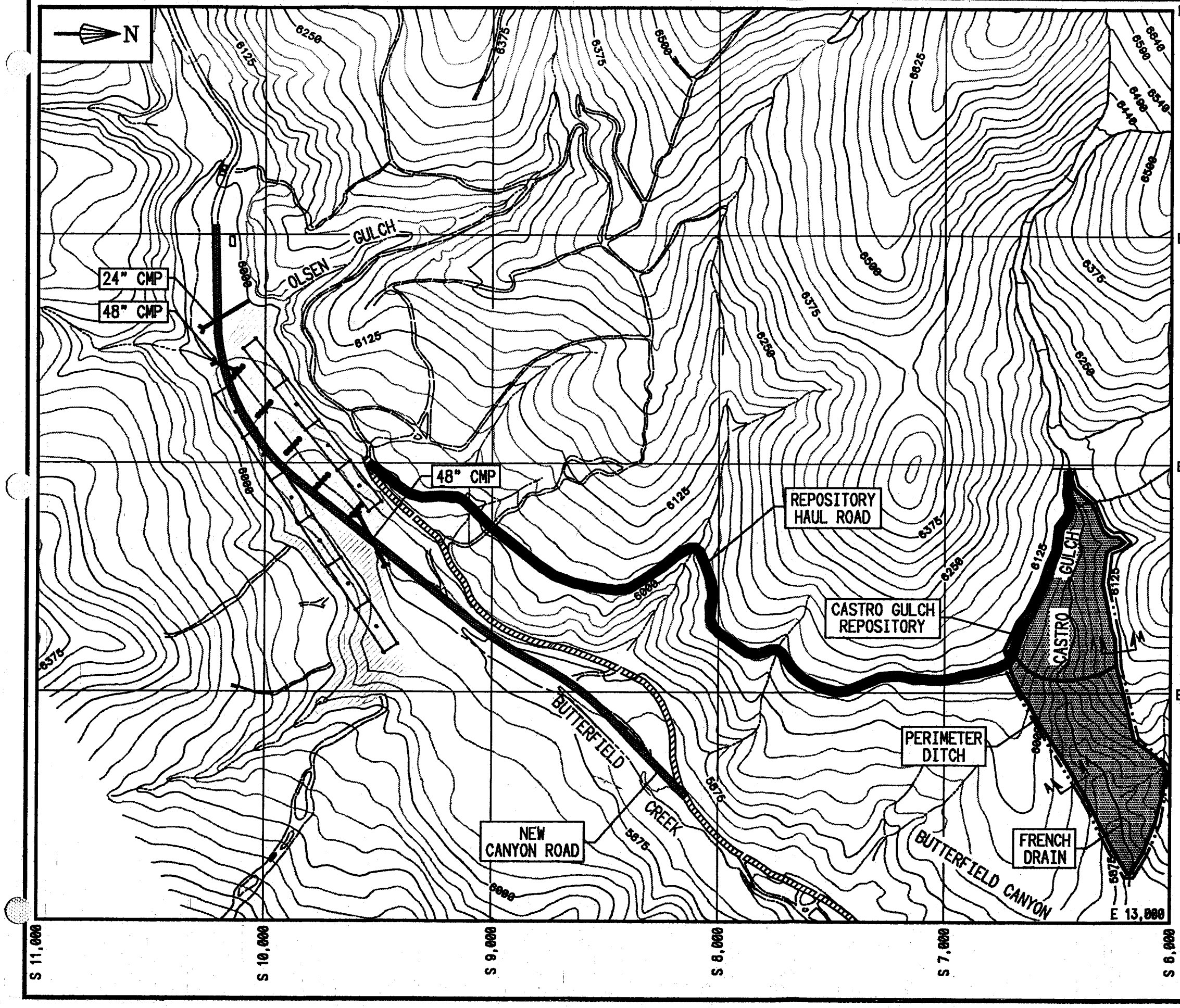
SEEPAGE COLLECTION PIPE & DRAIN DETAIL
NO SCALE

LEGEND
- EXISTING GRADE (WASTE ROCK FILL)
- PROPOSED WASTE ROCK FILL
- ASSUMED TOP OF ALLUVIUM
- SEEPAGE COLLECTION PIPE & DRAIN PIPE

0 60 120
SCALE IN FEET

EXHIBIT #4

PLANT PROJECTS GROUP	KENNECOTT UTAH COPPER
SCALE: GDL 6/22/01 RKC 10/30/01	BUTTERFIELD MINE WASTE DUMPS CASTRO GULCH REPOSITORY PROFILE
Job No. ----	Dwg. No. 451-T-466 4



LEGEND

- 228' — 5-POINT RECTANGLE COMPOSITE SAMPLE SUBSITE LOCATIONS
- SUBSAMPLE POINTS
- 5-POINT LINEAR COMPOSITE SAMPLE SUBSITE LOCATIONS
- CORRUGATED METAL PIPE (CMP)
- REPOSITORY HAUL ROAD
- EXISTING ASPHALT ROAD
- NEW CANYON ROAD
- EXISTING DIRT ROAD
- BINGHAM MINE WASTE DUMP
- BUTTERFIELD WASTE ROCK FOOTPRINT
- CASTRO GULCH REPOSITORY

NOTE:

1 - TOPOGRAPHY DERIVED FROM "1998" AERIAL MAP.

0 200 400

SCALE IN FEET

EXHIBIT #5

PLANT PROJECTS GROUP	KENNECOTT UTAH COPPER
SCALE 1"=200' DATE	BUTTERFIELD WASTE ROCK POST REMOVAL SAMPLING PLAN
RKC	
RKC	
Job No. ——	Dwg. No. 451-T-919 REV 0